Massachusetts
Department
Of
Public Health

Evaluation of Cancer Incidence in Maynard, MA

September, 2003

Bureau of Environmental
Health Assessment,
Community Assessment
Program

Evaluation of Cancer Incidence
in Maynard, MA

TABLE OF CONTENTS

I. Introduction/Methods

In the spring of 2002, a resident of Maynard and the Maynard Board of Health contacted the Massachusetts Department of Public Health, Bureau of Environmental Health Assessment (MDPH, BEHA) regarding concerns over a suspected increased incidence of cancer in the Nick Lane neighborhood, located in the northwest part of the town (see Figure 1). Specific concerns focused on resident reports of a large number of cancer diagnoses among individuals living in this area of Maynard and whether this may represent an atypical pattern or possibly be related to a common environmental factor. In addition, recent data from the Massachusetts Cancer Registry's (MCR's) regularly published report *Cancer Incidence in Massachusetts: City and Town Supplement*, which provides cancer incidence data for each city and town in Massachusetts, indicated that incidence rates for lung and bronchus cancer and cervical cancer were statistically significantly elevated townwide in Maynard for the time period 1994-1998 (MCR, 2001).

To determine whether an atypical pattern of cancer in the Nick Lane area of Maynard exists, the BEHA's Community Assessment Program (CAP) reviewed MCR data files for residents of this area who had been diagnosed with any cancer type to confirm cancer diagnoses reported among residents of the Nick Lane neighborhood. The MCR (housed within the MDPH Bureau of Health Statistics, Research, and Evaluation) is a population based surveillance system that has been monitoring cancer incidence in the Commonwealth since 1982. All new diagnoses of cancer among Massachusetts residents are required by law to be reported to the MCR within six months of the date of diagnosis (M.G.L. c.111. s 111b). This information is kept in a confidential database. The 17-year period from 1982-1998 constitutes the time period for which the most complete and recent cancer incidence data were available from the MCR at the initiation of this investigation. However, since the MCR is a continual surveillance system for cancer, reports of individuals in Maynard diagnosed since 1998 to the present time were reviewed. An evaluation of the geographic pattern of cancer was also conducted to determine whether any specific cancer type appeared to be concentrated within the Nick Lane area of Maynard. Place of residence at the time of diagnosis was mapped for all individuals diagnosed with cancer in this area to assess any possible geographic concentration of cases. For confidentiality reasons, maps of the location of individuals diagnosed with cancer cannot be provided in this report.

To address Board of Health concerns about recent town-wide elevations in lung and bronchus cancer and cervical cancer, the CAP evaluated cancer incidence rates for these two cancer types in Maynard as a whole for the 17-year time period 1982-1998. Incidence rates for lung and bronchus cancer and cervical cancer were also evaluated for three smaller time periods (i.e., 1982-1986, 1987-1992, and 1993-1998) to assess possible trends over time. In order to determine whether cancer incidence in a community is occurring at a higher or lower rate than expected, a statistic called the standardized incidence ratio (SIR) is calculated using data from the MCR. More specifically, an SIR is the number of observed cancer cases in a town divided by the number of expected cases based on the population of the town and the state's cancer rates. An SIR greater than 100 indicates that more cancer cases occurred than expected; an SIR less than 100 means that fewer cases occurred than expected. For example, an SIR of 150 is interpreted as 50 percent more cases than expected; an SIR of 90 indicates 10 percent fewer cases than expected. When an SIR is statistically significant, as indicated by an asterisk symbol (*), there is less than a 5% chance that the observed number of cases is due to chance alone. SIRs and 95% confidence intervals (CIs) are not calculated when the observed number of cases is less than five. A more detailed explanation of SIRs and 95% CIs is provided in Attachment A. In addition, the CAP also evaluated the spatial distribution of individuals diagnosed with lung and bronchus cancer and cervical cancer to determine whether a specific pattern exists at smaller geographic levels within the town of Maynard. This was accomplished by mapping the address at the time of diagnosis for each individual with either of these two cancer types to observe whether concentrations of cases exist in Maynard at the neighborhood level. Again, for confidentiality reasons, maps of the location of individuals diagnosed with cancer cannot be provided in this report.

II. Cancer Incidence in the Nick Lane Neighborhood

The Nick Lane neighborhood is located in the northwest portion of Maynard bordering the town of Stow. For this evaluation, we reviewed the pattern of cancer diagnoses on Nick Lane and adjacent streets in the area including Glenn Drive, Michael Road, Patti Lane, Summer Street (part), Brian Way, Durant Avenue, Sunset Road, Reo Road, Dix Road, Nancy Circle, Dane Road, George Road, Rice Road, and Paul Road (see Figure 1). In general, our review found no atypical pattern of cancer in the Nick Lane neighborhood. From 1982-2002, a total of 21 different types of cancer were diagnosed among residents of this area, representing the occurrence of different diseases. The most commonly reported diagnoses included cancers of the lung and bronchus, breast, prostate, and colon. These are the

four most common types of cancer diagnosed among men and women in Massachusetts and this pattern is consistent with national and statewide trends in cancer incidence. Together, these cancer types represented more than half (56%) of the cancer diagnoses in this area. There were also a number of other cancer types diagnosed among residents of this area of Maynard over the 20 year period reviewed. However, the types of cancer that occurred varied in nature and there was no specific pattern or geographic concentration of any one cancer type within this neighborhood. Also, the years of diagnosis for these individuals varied throughout the 20 years reviewed, indicating no apparent trend or pattern in the time of diagnosis.

In response to specific concerns regarding cancers of the bladder and stomach, the pattern of these diseases in the Nick Lane neighborhood was also evaluated. From 1982 – present, there were some diagnoses of bladder cancer and stomach cancer among residents of this area. Although cancer incidence rates cannot be calculated for small geographic areas such as neighborhoods, the occurrence of these cancer types in the Nick Lane area does not appear to be atypical. Moreover, the three individuals diagnosed with bladder cancer did not reside in close proximity to each other.

The majority of cancer types diagnosed among residents of the Nick Lane neighborhood are predominantly associated with non-environmental factors such as family history, smoking, diet, and other lifestyle behaviors. Because the MCR collects some information related to risk factors (e.g., smoking history) for individuals diagnosed with cancer, this data was reviewed to better characterize the incidence patterns of cancer in this area of Maynard. This included a review of age at diagnosis, gender, smoking history, and occupation.

Age is an important risk factor in many cancers. Different cancers occur with different frequencies among the various age groups, and most cancer types occur more frequently in older populations (i.e., age 50 and over). The average age at diagnosis among individuals in this neighborhood with any type of cancer was 59 and the majority of individuals (78%) were age 50 or older when they were diagnosed. Review of the age and gender pattern among these individuals indicates that, with the exception of breast cancer (discussed below), the incidence of cancer in this area is consistent with established prevalence patterns of disease in the general population. Because cigarette smoking is also an important risk factor in the development of several cancer types, including cancers of the lung and bronchus, oral and pharynx, esophagus, bladder, kidney, stomach, and pancreas, smoking history was reviewed for

each individual in the Nick Lane area who had been diagnosed with a smoking related cancer. Of the 26 individuals with a smoking-related cancer, 20 (77%) reported being current or former smokers at the time of diagnosis, five were non-smokers, and smoking history was unknown for one individual. Therefore, it is likely that smoking played a role in the development of cancer among some residents of the Nick Lane neighborhood. In addition, some occupational exposures, such as jobs involving contact with chemicals, have been associated with an increased risk for developing certain types of cancer. A review of occupation as reported to the MCR showed that some of the individuals diagnosed with cancer in this area of Maynard worked in jobs that could be related to an increased risk for developing their cancer. Finally, based on our review of the geographic pattern of cancer, there were no unusual concentrations of cancer diagnoses in this area of Maynard.

We were not able to confirm the diagnoses of all individuals with cancer reported by residents of the Nick Lane neighborhood with the MCR. There are several reasons for this described below. At the time of this evaluation, the MCR data was complete through 1998, however, this is an on-going surveillance system that collects reports on a daily basis. Although we reviewed the MCR data for cancer diagnoses in this area of Maynard through the present time, it is possible that some residents of this neighborhood with cancer may not be included in the MCR files. For example, some of these individuals may have been diagnosed prior to 1982 when the MCR began collecting information on individuals in the state diagnosed with cancer. Similarly, some individuals with recent cancer diagnoses may not have been reported to the MCR yet. It is also possible that some individuals resided at or reported an address other than the Nick Lane neighborhood at the time of their diagnosis (e.g., a P.O. Box). For example, we identified some individuals reported by residents of the Nick Lane neighborhood at other addresses in Maynard. Finally, a diagnosis of cancer may have been incorrectly reported for some individuals.

III. Review of Breast Cancer in the Nick Lane Neighborhood

The pattern of breast cancer in the Nick Lane neighborhood exhibited a slightly different trend than expected with respect to established age patterns for this disease. Since 1982, a total of 17 individuals were diagnosed with breast cancer in the general Nick Lane neighborhood, with the majority diagnosed during the 1990s. This is consistent with trends noted in both Massachusetts and the U.S where the increase in the incidence of breast cancer during the 1990s has been attributed, at least in part, to improved and increased early-detection methods (i.e., mammography and other screening techniques)

(Devesa et al., 1995). However, women in the Nick Lane neighborhood were, on average, slightly younger at the time of their breast cancer diagnosis than women diagnosed in the general population. While the average age at diagnosis among women residing in the Nick Lane neighborhood was 56 years, almost half (n=8) of the diagnoses occurred among women under the age of 50 years (in their 30s and 40s). This compares to about 23% of breast cancers diagnosed among women in this age group in the general population (ACS, 2002a). However, further review of the geographic distribution of Maynard women diagnosed with breast cancer under the age of 50 did not reveal any other atypical patterns of individuals in the Nick Lane neighborhood in comparison to other areas of town. In general, breast cancer diagnoses were distributed fairly evenly across town and seemed to coincide closely with the pattern of population in Maynard.

Accurate age-group and gender specific population data are required to calculate SIRs. Because this data is only available at the town or census tract level, rates of breast cancer in Maynard cannot be calculated at the neighborhood level. However, to determine whether the pattern of breast cancer observed in the Nick Lane neighborhood was representative of the pattern of breast cancer in Maynard as a whole, town-wide SIRs were calculated for the time period 1982-1998, the time period for which the most complete and recent cancer incidence data were available from the MCR at the time of this analysis. Review of this information showed that breast cancer is occurring at a rate slightly lower than expected in Maynard (118 diagnoses among females observed vs. approximately 121 expected, SIR=98). Moreover, a review of breast cancer SIRs for specific age groups in Maynard indicates that the distribution of diagnoses by age is as expected based on the statewide experience (see Table 1). That is, in general, breast cancer in Maynard occurred at approximately the rate expected for all age groups with a slightly higher incidence among older women (i.e., ages 65-74). Of the 118 women diagnosed with breast cancer in Maynard between 1982-1998, 22% were under the age of 50 at the time of diagnosis, consistent with established patterns of disease in the general population. Therefore, this analysis suggests that the age distribution observed among women diagnosed with breast cancer residing in the Nick Lane area of Maynard is not necessarily a reflection of the general pattern of breast cancer in the town as a whole.

To better understand the pattern of breast cancer in the Nick Lane neighborhood, we also reviewed the histology or cell type distribution of breast cancer diagnoses in this area. This type of information can help to assess whether an atypical pattern could be occurring when compared to known or established

incidence trends. Studies have shown that the distribution of histologic types of early-onset breast cancer is not different from the distribution seen among older women (Bertheau et al., 1999). In the general population, approximately 80% of all invasive breast cancer diagnoses are infiltrating ductal carcinomas and about 10% are infiltrating lobular carcinomas (ACS, 2002a). The histology distribution observed in the Nick Lane neighborhood was somewhat consistent with this pattern: 71% of breast cancer diagnoses in the Nick Lane area were of the infiltrating ductal carcinoma type, 18% were either lobular carcinomas or combined ductal and lobular carcinomas, one was a rarer type of breast cancer that accounts for about 2% of all breast cancer diagnoses in the general population (ACS, 2002a), and one was unclassified as to specific histology type. This information suggests that the pattern of breast cancer in the Nick Lane neighborhood is not atypical with respect to histology or the different types of breast cancer that can occur.

The staging of breast cancer categorizes the extent of the disease and its spread at the time of diagnosis. Communities in which large portions of the women receive routine breast cancer screening are expected to have a greater number of women diagnosed at the early stages of the disease. Likewise, communities with low screening rates would be expected to have more cases diagnosed at the later stages of disease. Invasive breast cancer is typically classified as one of four stages of disease: localized, regional, distant, and unknown. Localized breast cancer represents a diagnosis in which the tumor is invasive but the cancer is confined to the breast. Regional refers to a tumor that has spread beyond the organ of origin (breast), including spread to adjacent tissues and organs, lymph nodes, or both. Distant stage breast cancer is a cancer that has metastasized or spread to organs other than those adjacent to the organ of origin, to distant lymph nodes, or both (MCR, 1996). Some of the cases are reported to the MCR with an unknown stage meaning that, at the time of reporting by a hospital or other facility (e.g. physician's office), the tumor had not been staged. In Maynard between 1982-1998, 59% of invasive breast cancer cases reported were local tumors, 31% were regional, 6% were distant, and 4% were of an unknown stage. This is very similar to the distribution observed statewide during this time period (61% local, 28% regional, 6% distant, and 6% unknown).

Residents of the Nick Lane neighborhood who were diagnosed with breast cancer from 1982-present were diagnosed at slightly more advanced stages of disease compared to women in Maynard as a whole. Of the 17 individuals diagnosed with breast cancer in this area of Maynard since 1982, 7 (41%) were local tumors, 7 (41%) were regional, 2 (12%) were distant, and one (6%) was of unknown stage. It is

possible that the higher percentage of later stage tumors indicates that women in this area are not being screened routinely for breast cancer. However, it is difficult to know the importance of these differences given the relatively small number of diagnoses in the Nick Lane neighborhood. Moreover, the observed distribution may reflect the younger average age of diagnosis in this area of Maynard. For breast cancer, young age at diagnosis is often associated with advanced stage and more aggressive tumors (Gajdos et al., 2000; Bertheau et al., 1999). Of the women in the Nick Lane neighborhood under the age of 50 at the time of diagnosis, the majority were diagnosed with later rather than earlier stage cancers.

Reproductive factors such as late age (i.e., after age 30) at first full-term pregnancy and low parity (i.e., having few or no children) can increase a woman's risk of developing breast cancer. Therefore, available data regarding mean age at first birth and parity among women in Maynard were reviewed to determine whether the presence of these factors could be related to increased breast cancer risk among this population. Although this information is available at the town and state level, it is not readily available for individuals diagnosed with breast cancer in Maynard. Therefore, the data reviewed here may not reflect individual risk factors among the women diagnosed with breast cancer in the Nick Lane neighborhood. Rather, it provides an indication of the overall prevalence of these risk factors in the population of Maynard compared to the state.

In 1975, the mean age at first birth among women in Maynard was 24.5 years compared to 23.1 years among women in Massachusetts as a whole. In 2000, the mean age at first birth among women in Maynard was 30.3 years compared to 27.9 years among women in Massachusetts. Therefore, women in Maynard are slightly older at the time of their first full-term pregnancy than women in the state as a whole and the age at first birth has increased for women in Maynard over time. In Maynard, the percentage of live births among women age 30 years or older increased from 26% in 1975 to 72% in 2000. This is in contrast to rates among women of the same age group in Massachusetts: in 1975, 21% of all live births were to women age 30 or older in Massachusetts compared to 54% in 2000. However, the increase was more dramatic in Maynard as compared to Massachusetts.

Parity data for the 25-year time period 1975-2000 were also reviewed for Maynard and Massachusetts. The percentage of all births that were first births increased among women age 30 or older in both Maynard and Massachusetts from 1975 to 2000. In Maynard, 21% of first births occurred among women age 30 or older in 1975 compared to 65% in 2000. In Massachusetts, 8% of first births occurred

among women age 30 or older in 1975 compared to 44% in 2000. Therefore, a higher percentage of women in Maynard are age 30 or older at the time of their first full-term pregnancy (65%) than in the state of Massachusetts as a whole (44%). Finally, rates of multiple births were examined for women in Maynard and in Massachusetts. In 1975, approximately 25% of all births were a third or higher birth among women in both Maynard and Massachusetts. Although this number decreased to 22% among women in the state in 2000, in Maynard, only 13% of all births were a third or higher birth in Maynard. Therefore, the data suggests that women in Maynard over time are having children at older ages and are having fewer children compared to women in the state as a whole. This data also suggests that women in Maynard may have a higher prevalence of reproductive risk factors that are related to an increased risk for breast cancer than women in the state as a whole. However, as noted above, it is unknown if the women diagnosed with breast cancer in Maynard exhibit these risk factors.

In 1994 and 1995 two genes, BRCA1 and BRCA2, were discovered that suggested a genetic susceptibility to breast cancer. These genes normally help to prevent cancer by making proteins that keep cells from growing abnormally. However, if a person inherits a mutated gene, the protein will be less effective and the chance of developing breast cancer will increase. Recent studies estimate that about 10% of breast cancers can be attributed to inherited mutations in breast cancer related genes such as BRCA1 and BRCA2 (ACS, 2002a). The prevalence of these mutations is higher among women diagnosed with breast cancer at younger ages than among women diagnosed at older ages (Peto et al., 1999; Newman et al., 1998; Malone et al., 1998). Moreover, prevalence is higher among breast cancer patients with a family history of disease (Malone et al., 1998; Newman et al., 1998). Unfortunately, information regarding family history and the occurrence of these genetic mutations among individuals in Maynard is not available. Therefore, the extent to which genetic susceptibility could have played a role in the incidence of breast cancer among women in the Nick Lane neighborhood is unknown.

Other risk factors for breast cancer include personal history of benign breast disease; lifestyle factors such as diet, body weight, lack of physical activity, and alcohol consumption; and cumulative lifetime exposure to estrogen. Although most risk factors for breast cancer in younger women are similar to those for breast cancer at any age, some risk factors, such as menstrual and reproductive risk factors as well as family history, may play a more important role in diagnosis at younger ages (Tavani et al., 1999).

Despite the vast number of studies on the causation of breast cancer, known factors are estimated to account for fewer than half of all breast cancers in the general population (Madigan et al., 1995). Researchers are continuing to examine potential risks for developing breast cancer, especially environmental factors. In Massachusetts, the BEHA is currently working with a contractor (Silent Spring Institute) to complete and release the results of the Cape Cod Breast Cancer and Environment Study, a large study involving interviews with over 2500 females and examining many different environmental exposure opportunities (e.g., pesticides). Results of the study are expected sometime in the winter of 2003/2004. For more information regarding risk factors for breast cancer, please refer to Attachment B.

IV. Cancer Incidence for Selected Cancer Types in Maynard

In response to concerns about recent town-wide elevations in the incidence of lung and bronchus cancer and cervical cancer, we reviewed MCR data for these two cancer types for the town of Maynard as a whole for the 17-year time period 1982-1998. As described above, standardized incidence ratios (SIRs) were calculated for each of these cancer types for the time period 1982-1998. In order to evaluate patterns or trends in cancer incidence over time, SIRs were also calculated for three smaller time periods (i.e., 1982-1986, 1987-1992, and 1993-1998). In addition, place of residence at the time of diagnosis was mapped for each individual using a computerized geographic information system. This allowed for a qualitative evaluation of the spatial distribution (i.e., point pattern) of individuals diagnosed with cancer. To protect confidentiality, maps of individuals diagnosed with cancer cannot be shown here, however, a summary of our evaluation is presented later in this report. Finally, to better characterize the incidence patterns of these cancers in Maynard, available data on risk factors (e.g., age at diagnosis, gender, and smoking history) from the MCR for individuals diagnosed with cancer of the lung and bronchus or cervix was reviewed. Results of these analyses are discussed below.

A. Lung and Bronchus Cancer

Table 2 summarizes lung and bronchus cancer incidence data for Maynard for the time period 1982-1998 as well as the three smaller time periods evaluated. During the 17-year time period 1982-1998, lung and bronchus cancer occurred slightly more often in Maynard than expected based on the state rate of this cancer type (119 cases observed vs. approximately 111 expected, SIR=107). However, this elevation was not statistically significant. Separate evaluation of this data by gender revealed that the

observed increase was due to additional diagnoses among males in the town (78 cases observed vs. approximately 66 expected) while females experienced a slightly lower-than-expected rate (41 cases observed vs. approximately 45 expected). Similar trends were observed during the earliest time period 1982-1986 and during the most recent time period 1993-1998. Moreover, during 1993-1998, the elevation observed among males in Maynard was statistically significant (34 cases observed vs. 22.9 expected, SIR=149, 95% CI=103-208). However, during 1987-1992, lung and bronchus cancer occurred slightly less often than expected in the town of Maynard among males and females combined (37 cases observed vs. approximately 39 expected) (see Table 2).

A review of the geographic pattern of individuals diagnosed with lung and bronchus cancer in Maynard revealed no apparent spatial concentrations at the neighborhood level that could not be attributed to factors such as higher population density (e.g., the presence of multi-unit housing complexes). That is, no atypical patterns with respect to place of residence emerged that would suggest a cluster or common factor (either environmental or non-environmental). The distribution of lung and bronchus diagnoses throughout Maynard seemed to coincide closely with the pattern of population in the town.

There are a number of important risk factors associated with the development of lung and bronchus cancer. For example, incidence is greater among males than it is among females. In Maynard, the majority of diagnoses (66%) were among males. Also, incidence increases sharply with age, peaking around age 60 or 70. The average age at diagnosis among individuals diagnosed with lung and bronchus cancer in Maynard was 68 and the majority (95%) of diagnoses occurred among individuals age 50 or older, which is consistent with established patterns of disease in the general population. The most important known risk factor for lung and bronchus cancer is cigarette smoking. Among the 119 individuals diagnosed with lung and bronchus cancer in Maynard during 1982-1998, 109 (92%) reported being current or former smokers at the time of diagnosis. Four (3%) were non-smokers and smoking history was unknown for six individuals (5%). This information suggests that smoking likely played an important role in the development of lung and bronchus cancer among residents of Maynard. For more information regarding risk factors for lung and bronchus cancer, please refer to Attachment B.

B. Cervical Cancer

Table 3 summarizes cervical cancer incidence data for Maynard for the time period 1982-1998 as well as the three smaller time periods evaluated. During the 17-year time period 1982-1998, cervical cancer

occurred slightly more often than expected among females in Maynard (11 cases observed vs. 8.6 expected). However, this elevation was based on approximately two additional diagnoses over the expected number and was not statistically significant. The overall elevation observed for the 1982-1998 time period was primarily due to increased diagnoses during the most recent time period evaluated, 1993-1998 (7 cases observed vs. 3 expected). Again, this elevation was not statistically significant (see Table 3). Because of the instability of incidence rates based on small numbers of cases (i.e., less than five), SIRs were not calculated for cervical cancer during some smaller time periods evaluated (i.e., 1982-1986 and 1987-1992). However, the expected number of cases was calculated to determine whether excess numbers of cases occurred. Review of this information revealed that during 1982-1986 and 1987-1992 cervical cancer occurred either equal to or less often than expected. It is uncertain based on this data whether the incidence of cervical cancer in Maynard is increasing over time or whether the observed elevation reflects random variation in cervical cancer incidence rates. Based on an evaluation of the geographic distribution of individuals diagnosed with cervical cancer, there were no atypical spatial patterns of cervical cancer diagnoses in Maynard.

Several risk factors are associated with the development of cervical cancer. For example, although this cancer type begins to appear in females in their twenties, the average age at diagnosis is between 50 and 55 years. Consistent with this estimate, among the 11 women diagnosed in Maynard during 1982-1998, the average age at diagnosis was 53 years (age range = 28-83). Environmental exposures are not thought to be associated with the development of cervical cancer. The most important risk factor for this cancer type is infection by the *human papilomavirus (HPV)*, which is sexually transmitted. To a lesser extent, cigarette smoking has also been suggested to increase the risk of cervical cancer. In Maynard, five of the 11 women diagnosed with cervical cancer reported being current or former smokers at the time of diagnosis, five were non-smokers, and smoking history for one woman was unknown. For more information regarding risk factors for cervical cancer, please refer to Attachment B.

V. Summary and Conclusions

When reviewing the incidence rates presented in this report, it is important to keep in mind that cancer is a common disease. The American Cancer Society estimates that one out of every three Americans will develop some type of cancer during his or her lifetime. Over the past forty years, the rise in the number of cancer cases generally reflects the increase in the population, particularly in the older age groups.

The most commonly diagnosed cancers for adult males include cancers of the prostate, lung and bronchus, and colon. Breast, lung and bronchus, and colon cancers are the most common cancer types diagnosed among females (ACS, 2002b).

Understanding that cancer is not one disease, but a group of diseases is also very important. Research has shown that there are more than 100 different types of cancer, each with different causative (or risk) factors. In addition, cancers of a certain tissue type in one organ may have a number of causes. Cancer may also be caused by one or several factors acting over time. For example, tobacco use has been linked to lung, bladder, and pancreatic cancers. Other factors related to cancer may include lack of crude fiber in the diet, high fat consumption, alcohol abuse, and reproductive history. Heredity, or family history, is an important risk factor for several cancers. To a lesser extent, some occupational exposures, such as jobs involving contact with asbestos, have been shown to be carcinogenic (cancer causing). Environmental contaminants have also been associated with certain types of cancer (Bang, 1996; Frumkin, 1995).

According to American Cancer Society statistics, cancer is the second leading cause of death in Massachusetts and the United States. Not only will one out of three people develop cancer in their lifetime, but this tragedy will affect three out of every four families. For this reason, cancers often appear to occur in "clusters," and it is understandable that someone may perceive that there are an unusually high number of cancer cases in their surrounding neighborhoods or towns. Upon close examination, many of these "clusters" are not unusual increases, as first thought, but are related to such factors as local population density, variations in reporting or chance fluctuations in occurrence. In other instances, the "cluster" in question includes a high concentration of individuals who possess related behaviors or risk factors for cancer. Some, however, are unusual; that is, they represent a true excess of cancer in a workplace, a community, or among a subgroup of people. A suspected cluster is more likely to be a true cancer cluster if it involves a large number of cases of one type of cancer diagnosed in a relatively short time period rather than several different types diagnosed over a long period of time (i.e., 20 years), a rare type of cancer rather than common types, and/or a large number of cases diagnosed among individuals in age groups not usually affected by that cancer. These types of clusters may warrant further public health investigation.

Although incidence rates for lung and bronchus cancer and cervical cancer were slightly elevated in Maynard during 1982-1998, based on the information reviewed, for the most part it does not appear that an atypical pattern of these cancer types is occurring in the town of Maynard or the Nick Lane neighborhood. Although some residents of Nick Lane and the surrounding neighborhood were diagnosed with cancer since 1982, a number of different cancer types were diagnosed over the last 20 years. Because cancer is not one disease but a group of many different types of diseases caused by many different factors, this information does not indicate an atypical pattern of any one cancer type in this area. In addition, no specific pattern with respect to place of residence or diagnoses over time emerged that would suggest a cluster or common factor in the Nick Lane area of Maynard. Review of individual risk factors suggests that smoking likely played an important role in the overall pattern of cancer evaluated among residents of this area. In addition, although the age distribution of women diagnosed with breast cancer in the Nick Lane neighborhood was slightly younger than the established age distribution for this disease, review of specific information with regard to the different types of breast cancer (e.g., histology and staging) and place of residence did not indicate a pattern suggesting a common risk factor (environmental or non-environmental) related to these diagnoses.

VI. Recommendations

Information reviewed related to risk factors for developing breast cancer indicate that women in Maynard as a whole may have a higher prevalence of reproductive risk factors such as late age at first birth and low parity compared to women in the state as a whole. Therefore, the CAP will continue to monitor the incidence of breast cancer in Maynard through the use of the MCR but recommends no further investigation of cancer incidence in the Nick Lane neighborhood of Maynard or in the town as a whole at this time. The CAP recommends that the Maynard Board of Health take steps to increase awareness among Maynard residents of risk factors for certain cancers and methods to reduce individual cancer risk.

VII. References

American Cancer Society. 2002a. Breast Cancer. Available at: http://www3.cancer.org/cancerinfo.

American Cancer Society. 2002b. Cancer Facts & Figures 2002. Atlanta: American Cancer Society, Inc.

Bang KM. 1996. Epidemiology of Occupational Cancer. Occupational Medicine. 11(3):467-485.

Bertheau P, Steinberg SM, Cowan K, and Merino MJ. 1999. Breast cancer in young women: clinicopathologic correlation. Seminars in Diagnostic Pathology. 16(3):248-256.

Devesa SS, Blot WJ, Stone BJ, et al. 1995. Recent cancer trends in the United States. Journal of the National Cancer Institute. 87(3):175-182.

Frumkin H. 1995. Carcinogens. In: Levy BS and Wegman DH, editors. Occupational Health--Recognizing and Preventing Work-Related Disease. 3rd ed. Boston: Little, Brown and Company. p. 293.

Madigan MP, Ziegler RG, Benichou J, et al. 1995. Proportion of breast cancer cases in the United States explained by well-established risk factors. J Natl Cancer Inst. 87(22):1681-5.

Malone KE, Daling JR, Thompson JD, et al. 1998. BRCA1 mutations and breast cancer in the general population: analyses in women before age 35 years and in women before age 45 years with first-degree family history. Journal of the American Medical Association. 279(12):922-929.

Massachusetts Cancer Registry. 2001. Cancer Incidence in Massachusetts 1994-1998: City and Town Supplement. Boston: U.S. Massachusetts Department of Public Health, Bureau of Health Statistics, Research, and Evaluation; 2001 October.

Massachusetts Cancer Registry. 1996. Massachusetts Cancer Registry Abstracting and Coding Manual for Hospitals. 2nd ed. Massachusetts Department of Public Health, Bureau of Health Statistics, Research and Evaluation, Boston, MA. 1996 March.

Newman B, Mu H, Butler L, et al. 1998. Frequency of breast cancer attributable to BRCA1 in a population-based series of American women. Journal of the American Medical Association. 279(12):915-921.

Peto J, Collins N, Barfoot R, et al. 1999. Prevalence of BRCA1 and BRCA2 gene mutations in patients with early-onset breast cancer. Journal of the National Cancer Institute. 91(11):943-949.

Tavani A, Gallus S, La Vecchia C, et al. 1999. Risk factors for breast cancer in women under 40 years. Eur J Cancer. 35(9):1361-1367.

Attachment A

Explanation of a Standardized Incidence Ratio (SIR) And 95% Confidence Interval

In order to evaluate cancer incidence a statistic known as a standardized incidence ratio (SIR) was calculated for each cancer type. An SIR is an estimate of the occurrence of cancer in a population relative to what might be expected if the population had the same cancer experience as some larger comparison population designated as "normal" or average. Usually, the state as a whole is selected to be the comparison population. Using the state of Massachusetts as a comparison population provides a stable population base for the calculation of incidence rates. As a result of the instability of incidence rates based on small numbers of cases, SIRs were not calculated when fewer than five cases were observed.

Specifically, an SIR is the ratio of the observed number of cancer cases to the expected number of cases multiplied by 100. An SIR of 100 indicates that the number of cancer cases observed in the population evaluated is equal to the number of cancer cases expected in the comparison or "normal" population. An SIR greater than 100 indicates that more cancer cases occurred than expected and an SIR less than 100 indicates that fewer cancer cases occurred than expected. Accordingly, an SIR of 150 is interpreted as 50% more cases than the expected number; an SIR of 90 indicates 10% fewer cases than expected.

Caution should be exercised, however, when interpreting an SIR. The interpretation of an SIR depends on both the size and the stability of the SIR. Two SIRs can have the same size but not the same stability. For example, an SIR of 150 based on 4 expected cases and 6 observed cases indicates a 50% excess in cancer, but the excess is actually only two cases. Conversely, an SIR of 150 based on 400 expected cases and 600 observed cases represents the same 50% excess in cancer, but because the SIR is based upon a greater number of cases, the estimate is more stable. It is very unlikely that 200 excess cases of cancer would occur by chance alone.

To determine if the observed number of cases is significantly different from the expected number or if the difference may be due solely to chance, a 95% confidence interval (CI) was calculated for each SIR. A 95% CI assesses the magnitude and stability of an SIR. Specifically, a 95% CI is the range of estimated SIR values that has a 95% probability of including the true SIR for the population. If the 95% CI range does not include the value 100, then the study population is significantly different from the comparison or "normal" population. "Significantly different" means there is less than 5% percent chance that the observed difference is the result of random fluctuation in the number of observed cancer cases.

For example, if a confidence interval does not include 100 and the interval is above 100 (e.g., 105-130), then there is statistically significant excess in the number of cancer cases. Similarly, if the confidence interval does not include 100 and the interval is below 100 (e.g., 45-96), then the number of cancer cases is statistically significantly lower than expected. If the confidence interval range includes 100, then the true SIR may be 100, and it cannot be concluded with sufficient confidence that the observed number of cases is not the result of chance and reflects a real cancer increase or decrease. Statistical significance is not assessed when fewer than five cases are observed.

In addition to the range of the estimates contained in the confidence interval, the width of the confidence interval also reflects the stability of the SIR estimate. For example, a narrow confidence interval (e.g., 103--115) allows a fair level of certainty that the calculated SIR is close to the true SIR for the population. A wide interval (e.g., 85--450) leaves considerable doubt about the true SIR, which could be much lower than or much higher than the calculated SIR. This would indicate an unstable statistic.

Source: Massachusetts Department of Public Health, Bureau of Environmental Health Assessment (October 2001)

Attachment B